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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Robert Keller	Docket No.:	TI-30714
Serial No.:	09/620,943	Art Unit:	2882
Filed:	07/21/2000	Examiner:	Kao, Chih
For:	OPTICAL WIRELESS LINK	Confirm. No.:	4054

DECLARATION OF PRIOR INVENTION IN THE UNITED STATES TO OVERCOME CITED PATENT (37 C.F.R. § 1.131)

MAILING CERTIFICATE UNDER 37 C.F.R. §1.8(A) I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Box AF, Washington, D.C. 20231.

William B. Kempler 2/19/03

William B. Kempler, Reg. No. 28,228 Date

Assistant Commissioner for Patents
Washington, DC 20231

Dear Sir:

1. This declaration is to establish completion of the invention in this application in the United States at a date prior to July 17,2000, which is the first effective date of the cited U.S. patent to Huibers, et al. (6,337,760), which was cited by the Examiner.

2. The individual making this declaration Robert Keller, one of the inventors. Coinventor Jose Melendez is no loner employed by Texas Instruments, Incorporated and has a mailing address outside the continental United States.

3. To establish the date of completion of the invention of this application, a true copy of a portion of the document describing a working laboratory model of the invention is submitted as evidence. (Exhibit A) References to actual components used in the model have been removed.

4. Attached as Exhibit B is a true copy of the drawing of a demonstration setup of a second embodiment of the invention and an email describing its successful operation before July 17, 2000 and referring to the first embodiment (Exhibit A).

5. This declaration is submitted prior to final rejection.

6. As a person signing below:

I hereby declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

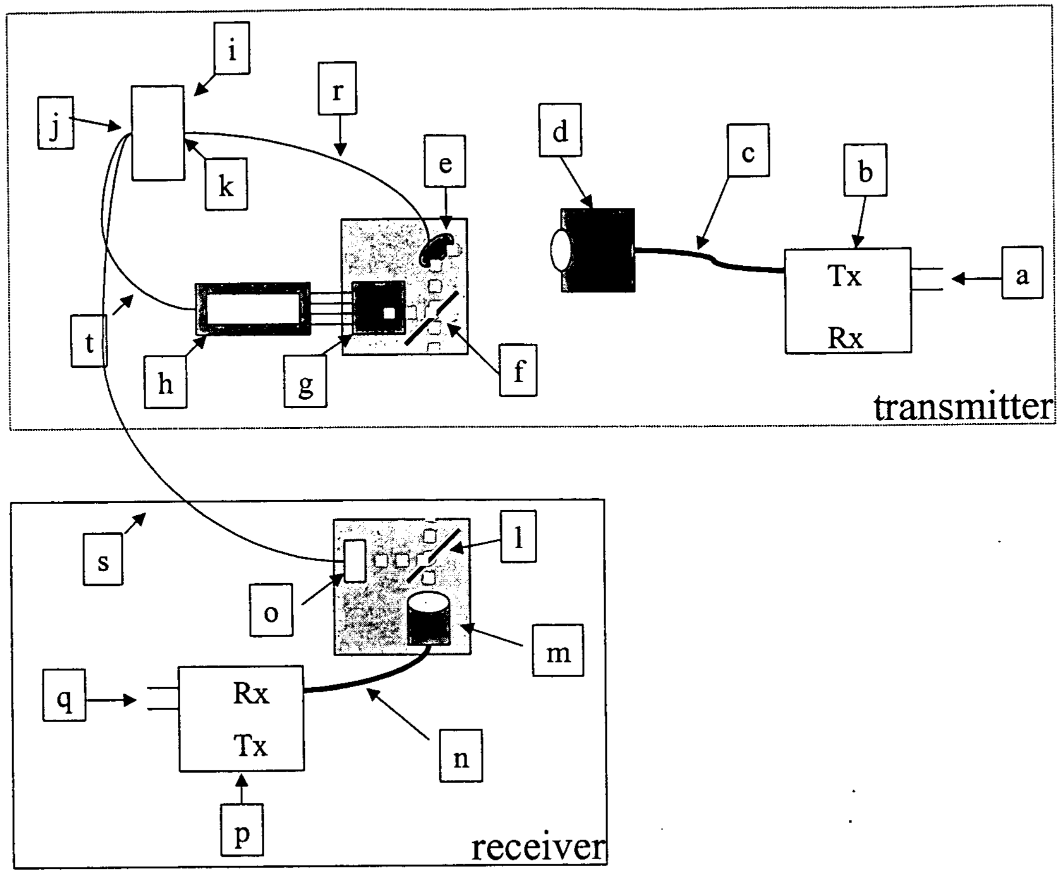
Respectfully submitted,

Robert Keller

Robert Keller

Date: 2/18/03

Exhibit A



(a) Data Input: Differential
(b) Electro-Optical Transceiver:
(c) 62.5/125 multimode optical fiber
(d) Collimation Kit with lens and optical fiber adaptor
(e) Beam steering device: TI NxN micromirror
(f) Beam splitter:
(g) Position Sensitive Detector (PSD):
(h) Versitile Position Sensing Amplifier:
(i) IBM Compatible PC with A/D and D/A cards
(j) Input to A/D card
(k) Input to D/A card
(l) Beam splitter:
(m) Fiber collimator:
(n) 400μm core optical fiber
(o) Si PIN detector:
(p) Electro-Optical Transceiver:
(q) Data Output: differential PECL data
(r) Ribbon cable between D/A card and micromirror
(s) Twisted pair cable between detector and A/D card
(t) Ribbon cable between Amplifier output and A/D card

Description:

The differential PECL data (a) is inputted to the transmitter side of the electro-optical transceiver (b). The transceiver emits an infrared light signal based on the input data that is coupled into the fiber optic (c). The other end of the fiber optic is connected to a collimating lens assembly (d). The collimated light output

from (d) is reflected off the 2-axis, variable angle TI NxN micromirror (e). The reflected light passes through a beam splitter (f), where part of the light is incident upon a position sensitive detector (g). The 4 electrical outputs of the PSD (f) are amplified by the Position Sensing Amplifier (g) and converted into voltages corresponding to the X and Y position of the light on the PSD. As the angle of the NxN micromirror varies, the position of the light spot on the position sensitive detector changes in a one-to-one relationship. The X and Y position output voltages of the Amplifier (g) are connected to an A/D board (i) in the computer (h). By converting the X and Y position voltages to digital information in the A/D board (i), the computer can compute the instantaneous orientation of the NxN micromirror (e), which determines the direction the light exiting the transmitter. Separate currents in the mircomirror coils beneath the mirror and gimbal magnets independently determine the micromirror angles in the X and Y direction. The currents are generated by a D/A board (j) in the computer (h) that is connected to the micromirror by the ribbon cable (r).

The computer (h) controls the micromirror orientation by using a discrete closed loop Proportional/Integration/Derivative (PID) control algorithm to set the micromirror currents using feedback on the instantaneous micromirror orientation from the PSD. Following the treatment by Franklin (*Digital Control of Dynamic Systems*, Addison-Wessley, 1998), the algorithms for setting the gimbal current $I_G(k)$ and mirror current $I_M(k)$ at the time of step k using a step time of 200µs are

$$I_M(k) = I_M(k-1) + 37.1*E_M(k) - 70.98*E_M(k-1) + 34.79*E_M(k-2)$$

$$I_G(k) = I_G(k-1) + 31.0751*E_G(k) - 59.5*E_G(k-1) + 29.05*E_G(k-2)$$

Where $E_M(k)$ is the error between the mirror angle and the desired mirror angle at the time of step k and $E_G(k)$ is the error between the gimbal angle and the desired gimbal angle at the time of step k. $I_M(k)$ and $I_G(k)$ are in milliampheres and $E_M(k)$ and $E_G(k)$ are in degrees.

The light reflected by the mircromirror (e) that passes through the beamsplitter (f) leaves the transmitter and is directed in the direction of the receiver. In the receiver, a fiber collimator (m), a beam splitter and a photodetector (o) are arranged such that the image of the photodetector (o) in the beam splitter (l) is coincident with the fiber collimator (m). When the orientation of incoming light is optimized such the light reflected off the beamsplitter and incident on the photodetector (o) is maximized, the light passing through the beam splitter (l) enters the fiber collimator (m).

The output of the photodetector (o) is connected by the cable (s) to the D/A card (I) in computer (h). The direction of the transmitted light is varied such that the signal from the photodiode (o) is maximized. The transmitted light passing through the beam splitter (l) is focused by the fiber collimator (m) into the optical fiber (n). The other side of the fiber (n) is connected to the receiver side of an electro-optical transceiver (p). The transceiver (p) converts the received light signal into differential PECL data (q).

Exhibit B

From: Keller, Robert
Sent: Friday, 4:43 PM
To: Melendez, Jose
Cc: Dewa, Andy; Orcutt, John; Simpson, Bruce; Smith, Pat
Subject: Short Demo Status

Beam Steering:

I have been successful in incorporating the wireless RF RS232 with the computers and software as a low bandwidth feedback path. This means the receiver and transmitter are now truely wireless (before we had a feedback wire between the receiver and transmitter). The algorithm which establishes the link requires just 8 bytes of feedback, although a higher feedback rate would shorten the time of establishing the link. I have now setup the transmitter and receiver computers in separate cublicles, roughly 15 meters apart, and have been able to establish the link. All this is using the squarewave clock signal as a source.

Optics:

I need to improve my optics to increase the power density at the receiver. I hope to be able to improve the collimation, remove the receiver beam splitter and add receiver optics to increase the power.

Content:

Analog - Pat was very successful in implementing an amplifier to complete the , which produced a GREAT picture! If we had popcorn to go with the pepsi we could have a movie night. However, at much lower power levels (roughly what I could currently do without improvments in the optics), the picture was mostly noise. I am ordering a larger receiver diode which also has bit higher amplifier gain--this will should help increase the signal. Goal -- to get this to work with the optical wireless link next week.

Ethernet - I installed one of the optical ethernet cards and saw that it always transmits a clock pulse at 62.5 MHz. This is equivalent to 125 Mbps, which after 5B/4B conversion is equal to 100Mbps. To interface this with my transmitter, I am modifying my transceiver to drive the laser by the receiver signal rather than the clock chip I currently have. I have done this before so it should work. I hope that Gus can help me next week with the software and ethernet cards so we can see if a one-way link is feasible.

Regards,

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Optical Wireless Modem Demo Setup